Faint Companions of Isolated 2MIG Galaxies

V. E. Karachentseva[1] , I. D. Karachentsev[2] , and O. V. Melnyk[3,4]

[1]Main Astronomical Observatory, National Academy of Sciences, ul. Acad. Zabolotny 27, Kiev, 03680 Ukraine
[2]Special Astrophysical Observatory, Russian Academy of Sciences, Nizhnii Arkhyz, 369167 Russia [3] Institut d'Astrophysique et de Geophysique, Université de Liège, Allée du 6 Août, 17, B5C B4000 Liège, Belgium
[4] Astronomical Observatory, Taras Shevchenko University, Observatornaya 3, Kiev, 04053 Ukraine

Abstract

We present the results of a search for companions around the isolated galaxies from the 2MIG catalog. Among 3227 2MIG galaxies we detected 125 objects with a total of 214 neighbors having radial velocity differences of $\Delta V < 500$ km/s and projected separations of $R_p < 500$ kpc relative to the 2MIG galaxies. The median luminosity of the companions is 1/25 of the luminosity of catalog galaxies, which has little effect on the dynamic isolation of the latter. The median ratio of the orbital mass to the K-luminosity determined from 60 companions of E and S0 2MIG galaxies, $63 M_\odot/L_\odot$, is signficantly greater than that found from the spiral galaxy companions ($17 M_\odot/L_\odot$). We note that a fraction of 2MIG galaxies with companions may be a part of low-contrast diffuse structures: clouds and filaments.

Keywords: astronomical databases: catalogs -galaxies: dwarf -galaxies: evolution -galaxies: formation

1. INTRODUCTION

Measurements of radial velocities and projected separations of dwarf galaxies, located in the vicinity of normal isolated galaxies have been used by many authors to determine the masses of central galaxies and dark matter density profile around them. Zaritsky et al. [1] and Herbert-Fort [2] measured radial velocities and distances of 69 and 78 companions around the isolated Sb-Sc spirals, respectively, and estimated the typical masses of dark haloes up to the galactocentric distance of about 250 kpc. The capabilities of this approach have considerably expanded with the publication of the Sloan Sky Survey, SDSS [3] and other spectral surveys of broad areas of the sky: 2dFGRS [4] and 2MRS [5]. The kinematic features of the companions depending on the luminosity and morphology of central galaxies, as well as their redshifts z were studied in [6–10]. These authors used different ways of identifying both the isolated galaxies and their companions. According to [6], the dispersion of radial velocities of the companions decreases approximately from 120 km/s at the projected separation of about 20 kpc to around 60 km/s at the distance of approximately 350 kpc, and increases with luminosity of the central galaxy as $\sigma_v \propto L^{0.3}$, while the orbital mass-to-luminosity ratio increases as $M_{orb}/L \propto L^{0.5}$. Norberg et al. [9] noted that the dispersion of radial velocities of the companions does not essentially depend on the projected separation, and the orbital mass-to-blue (B-band) luminosity ratio is about $\sim 36 M_\odot/L_\odot$ and $\sim 180 M_\odot/L_\odot$ in spiral and elliptical galaxies, respectively. Investigating the surface density of a number of companions in the SDSS survey, Chen et al. [7] demonstrated that it 1.7 ± 0.1 decreases with projected separation R_p as R_p independently of the luminosity of central galaxy or the luminosity of companions. Similarly, the observational data on the companions were used to study the characteristics of "fossil" groups, where the central galaxy has an order higher luminosity than that of its faint companions [11–13].

It should be noted that there is a significant discrepancy between the results and conclusions of different authors. Its nature mainly lays in the requirements applied to the degree of isolation of studied

galaxies, which affects the relative number of optical (background) "companions" and, henceforth, the linear dimensions of the subsystem of physical companions and the radial velocity dispersion in it.

Compiling the 2MIG catalog of isolated galaxies [14], we paid attention to the cases where a well-isolated galaxy had small companions with radial velocities close to it. In this paper, we set ourselves to organize and analyze the data on such systems.

2. ISOLATED GALAXIES OF THE 2MIG CATALOG

The first catalog of isolated galaxies of the northern sky (KIG) [15] included 1050 galaxies brighter than $m_{ph} = 15.5^m$, around which the neighboring "significant" galaxies with angular diameters of a_i in the range of $a_1/4 < a_i < 4a_1$ satisfied the condition $x_i/a_i > 20$. Here a_1 means the standard angular diameter of the potentially isolated galaxy and x_i is the angular (projected) distance of its neighbor "i". The research has shown [16] that this simple criterion proved to be quite effective for the selection of dynamically isolated galaxies. With the advent of a photometrically homogeneous IR survey of the entire sky, the Two Micron All-Sky Survey (2MASS), [17], and a catalog of extended IR sources, 2MASS XSC [18], a similar approach was used to compile the 2MIG (2MASS Isolated Galaxies) [14] Catalog. The catalog includes galaxies with apparent K_s -magnitudes in the range of $4.0 \leq K_s \leq 12.0^m$ and infrared angular diameters $a_K \geq 30''$, in cases when all their significant neighbors with angular diameters a_i and angular distances x_i satisfy the condition $x_i/a_i > 30$. A more stringent constraint on the dimensionless distances x_i/a_i is conditioned by the fact that the IR diameter of a galaxy is on the average one and a half times smaller than its standard diameter. Since the 2MASS survey is not very sensitive to the blue galaxies of low surface brightness, during the selection of isolated galaxies we made an additional visual inspection of the neighborhood in the optical DSS survey images, and used the original criterion [15] to the neighboring "significant" galaxies. We also checked the radial velocities of significant neighbors, visible in the DSS survey, excluding the galaxy candidates with radial velocities close to their neighbor's velocity ($\mid \Delta V \mid < 500$ km/s).

As a result of such a multistage selection process, we compiled the 2MIG catalog of isolated galaxies, which includes 3227 objects. The effective depth of the catalog, about 6500 km/s, is about the same as that of the KIG. The main population of the 2MIG catalog is composed of spiral galaxies (80%), about 19% accounts for E and S0 objects, while the fraction of irregular and BCD galaxies does not exceed 1%.

Various optical and hydrogen characteristics of the sample of 2MIG galaxies were considered in [19]. According to the authors [19], the completeness of the catalog is about 80% up to the limiting apparent magnitude of $K_s = 11.5$. The isolation criterion selects into the 2MIG catalog 6.2% of the total number of 51572 galaxies with apparent magnitudes of $K_s < 12.0^m$, and angular diameters of $a_K > 30''$.

Currently, more than 70% of 2MIG galaxies have measured radial velocities. The comments to the catalog note the cases ($N \sim 140$ when near a given isolated galaxy, fulfilling the isolation criterion, there were insignificant neighbors with radial velocity difference of $\mid \Delta V \mid < 500$ km/s with respect to the given galaxy. Such cases were examined more thoroughly, and the results of these examinations are presented below.

3. A SEARCH FOR FAINT COMPANIONS AROUND 2MIG GALAXIES

The ongoing massive sky surveys and radial velocity measurements in ever more fainter galaxies lead to the discovery of dwarf companions of galaxies, which seemed to be absolutely isolated. In most cases, the galaxies remain to be dynamically isolated, since the presence of new small physical companions does not violate the adopted isolation conditions. An example of this situation is a well-isolated BCD galaxy NGC 1156 = KIG 121 = 2MIG 360, having apparent magnitudes of $B = 12.32^m, K_s = 9.54^m$ and the

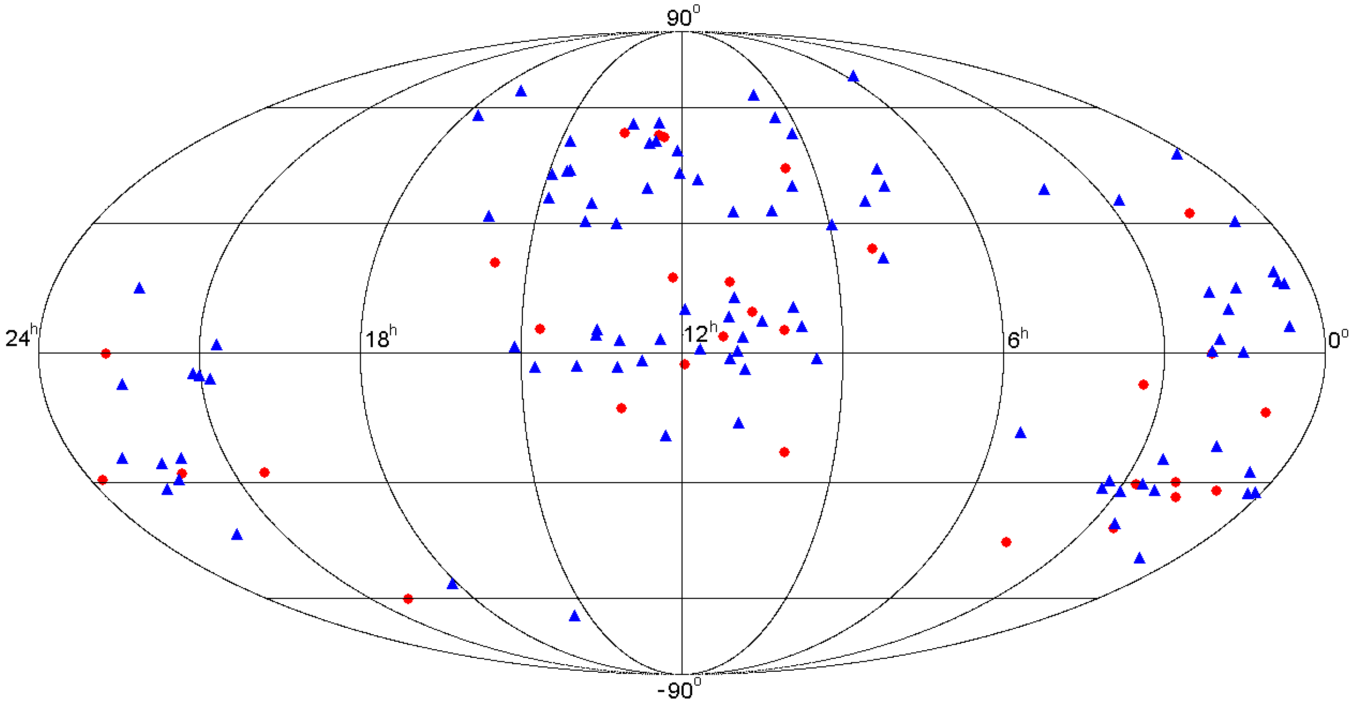

Figure 1: The distribution of 125 2MIG galaxies with companions in the sky in equatorial coordinates. The solid circles represent the E and S0 galaxies, while triangles—the spiral galaxies.

heliocentric radial velocity of $V_h = 376$ km/s. Within the HI survey AGES, carried out with the Arecibo radiotelescope, a dwarf galaxy AGES J030039+254656 was discovered [20] with an apparent magnitude of $B = 18.1^m$ and radial velocity of $V_h = 308$ km/s, located at an angular distance of $35'$ (80 kpc) from NGC 1156. There is every reason to call this dwarf galaxy a physical companion of NGC 1156, the presence of which, however, does not distort the dynamic autonomy of this bright galaxy.

The emergence of new data on radial velocities of galaxies allows making an a posteriori estimate of the eficiency of the isolation criterion used. Viewing the vicinities of 2MIG galaxies, we selected among their neighbors the galaxies with radial velocity difference of $\mid \Delta V \mid < 500$ km/s and projected separation of $R_p < 500$ kpc relative to the principal (2MIG) galaxy without restrictions on magnitude difference between the main galaxy and its companion.

As a result of our examination using the NED database (http://nedwww.ipac.caltech.edu), we identificated 125 2MIG galaxies with companions, the total number of which amounted to N = 214. The data on 339 these galaxies are presented in the Table. Its columns contain: (1) the number of a given galaxy in the 2MIG catalog and the presence of its companion/neighbors (in the following lines); (2) equatorial coordinates of galaxies at the epoch

2000.0; (3) morphological type of the galaxy in the de Vaucouleurs scale; (4) radial velocities in km/s with respect to the centroid of the Local Group (LG); (5) radial velocity measurement errors in km/s; (6) apparent B-magnitudes, taken from the NED or estimated by eye at the lack of data in the NED; (7) projected separation of the companion in kpc, determined from the radial velocity V_{LG} in the standard model with the Hubble parameter $H_0 = 73$ km/s/Mpc; (8) absolute magnitude of the 2MIG galaxy, corrected for the absorption in the Galaxy from Schlegel et al. [21], (9) the logarithm of orbital mass of the "2MIG galaxy— companion" pair in solar masses, calculated according to [22] as $M_{orb} = (16/\pi G)\Delta V^2 R_p$, , where G is the gravitational constant; (10,11) the logarithm of the orbital mass-to-luminosity ratio in solar units, in B and K_s -bands, respectively.

The distribution of 125 2MIG-galaxies with faint companions is presented in equatorial coordinates in Fig. 1. Elliptical and lenticular 2MIG galaxies ($T \leq 0$) are marked by solid circles, while the spiral galaxies are marked by triangles. Compared with the general distribution of 3227 catalog galaxies, the 2MIG galaxies with companions reveal a more heterogeneous distribution in the sky, which is to a large extent caused by the presence of the Galactic absorption belt, as well as the geometric features of the SDSS and other spectral surveys. This map reveals some evidence of association of 2MIG galaxies with companions into multiple systems.

It should be noted that the relative number of 2MIG galaxies with faint companions is less than 4%. If we assume that the main contribution to this number is given by the SDSS survey, then the total relative number of such galaxies in the 2MIG catalog may make up about 15%, indicating a fairly high efficiency of the applied isolation criterion.

4. SOME PROPERTIES OF ISOLATED GALAXY—COMPANION PAIRS

The distribution of 214 2MIG galaxy—companion pairs by the radial velocity difference and projected linear separation is presented in Fig. 2. Spiral 2MIG galaxies are marked with triangles, and E and S0 galaxies – with circles. Vertical bars indicate the mean square error of the velocity difference. Radial velocities of the companions relative to the main galaxy are distributed quite symmetrically with the mean of $\langle V_{sat} - V_{2MIG} \rangle = +11 \pm 13$ km/s, and a standard deviation of 187 km/s.

The velocity dispersion of companions to elliptical galaxies is somewhat greater than that of the spiral galaxies. The medians of the difference modulus are 205 and 130 km/s, respectively. A small contribution in this discrepancy is made by higher values of the velocity measurement errors in the E and S0 galaxies. The nature of companion distribution by the projected separations R_p looks almost uniform in the range of 0–500 kpc, varying distinctly from the dependence $N(R_p) \propto R_p^{-1.7}$, obtained in [7]. This may indicate the presence of a significant fraction of fictitious companions at the separations of $R_p > 300$ kpc, which were formed by the members of diffuse filaments and other elements of the large-scale structure.

Figure 3 shows the relation between the apparent B-magnitude difference of the given companion and the main galaxy, and the projected separation between them. As expected, there is a noticeable trend of the decreasing difference of values with increasing projected separation of the companion due to the 2MIG galaxy isolation selection conditions. On the average, the companions are approximately 3.5^m, or 25 times fainter than the 2MIG galaxies, and this difference is somewhat greater for the E and S0 galaxies (circles) than for the spiral ones (triangles).

If the 2MIG galaxy companions are subject to Keplerian motions, their relative radial velocities should correlate with the luminosity of the main component of the pair. Figure 4 presents the distribution of 2MIG galaxy–companion pairs by the radial velocity difference modulus and the absolute B-magnitude of the main galaxy, separately for the companions around the elliptical (E, S0) and spiral 2MIG galaxies. The slope of linear regressions in the figure shows the presence of a weak expected trend for the E and S0 galaxies, and a lack of a significant correlation for spiral galaxies. Note that the overwhelming majority of 2MIG galaxies with companions are the objects of high luminosity with the median absolute magnitudes of −20.3 (S) and −20.4 (E, S0).

An important dynamic characteristic of 2MIG galaxies with companions is an estimate of their orbital mass

$\langle M_{orb} \mid e \rangle = (32/3\pi G)(1 - 2e^2/3)^{-1} \Delta V^2 R_p$, where e is the eccentricity of companion's orbit [23]. Following [22], for an ensemble of pairs we have adopted as an average the value of $\langle e^2 \rangle = 1/2$. This estimate will be statistically unbiased only at zero measurement errors σ_V of galaxy radial velocities. As we can see from column (5) of the Table, the errors are quite significant for many companions.

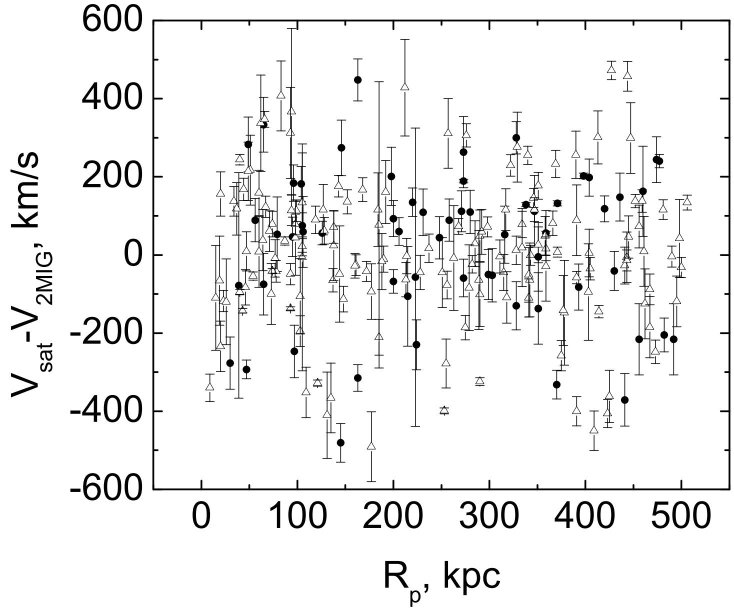

Figure 2: The distribution of 2MIG galaxies with companions by the difference of radial velocities and projected linear separations. 2MIG galaxies of early types are marked with circles, spiral galaxies – with triangles.

Therefore, in addition to M_{orb} , we calculated for each pair an unbiased estimate of orbital mass $M_{cor} = M_{orb}(\Delta V^2 - \sigma_{V1}^2 - \sigma_{V2}^2)/\Delta V^2$, making the quadratic subtraction of measurement errors from the

difference of radial velocities ΔV. The distribution of 2MIG galaxy–companion pairs by the M_{orb} and M_{cor} values is demonstrated in Fig. 5 in logarithmic scale. Approximately 30% of all pairs have negative values of M_{cor} due to large errors of σ_V. It is clear that the role of σ_V errors is significant in the region of $\log(M/M_\odot) < 12$. In general, if we account for the velocity measurement errors for an ensemble of 2MIG companions with the mean square velocity difference of 187 km/s and the mean square difference error of 62 km/s, it will reduce the mean estimate of the orbital mass by 16%.

The distribution of orbital mass estimates, normalized for the blue (B-band) and infrared (K_s -band) luminosity is illustrated in Fig. 6. The subsample of E and S0 galaxies in it is shaded. We have neglected the luminosity of 2MIG companion galaxies. It follows from these data that the median ratio of the orbital mass to the B-luminosity in the E and S0 galaxies is twice higher than that in the spirals. In the K_s -band this difference increases up to 3.7. The reason for this is the abundance among the 2MIG galaxies of spiral galaxies, seen nearly edge-on. Internal absorption of light in them, which we have not considered, reaches $\Delta m_B \simeq 1^m$. Therefore, we believe that the 3–4-fold difference between the median values of M_{orb}/L_K for elliptical and spiral galaxies is more realistic. However, this effect can also be caused by the photometric feature of the 2MASS survey, which underestimates the luminosity of the peripheral regions of galactic disks.

5. DISCUSSION

The orbital mass-to-luminosity ratio for 2MIG galaxies with companions (Fig. 6) is distributed over a fairly wide range, covering approximately 5 orders of magnitude. The shape of the left wing of the distribution is affected by the projection factors, as well as by the anticipated nature of the companions motion (the function of their orbit eccentricities). At the right wing of the distribution, in the range of

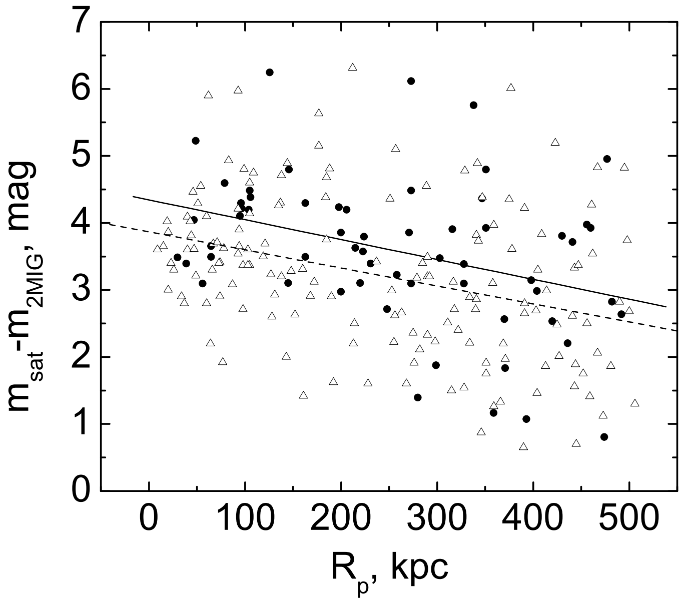

Figure 3: The distribution of 2MIG galaxies with companions by the difference in apparent B-magnitudes and projected separations.

$M_{orb}/L_K > 100M_{\odot}/L_{\odot}$ values, an admixture of fictitious 2MIG galaxy–companion pairs is potentially noticeable. Recall that in the standard ΛCDM model,

the value of the mean cosmic density $\Omega_m = 0.27$ corresponds to $M/L_K \simeq 100M_{\odot}/L_{\odot}$. The statistics of virial masses in the systems of galaxies of various scales in the near ($V_{LG} < 3500$ km/s) Universe reveals [24–26] that the median value of M_{vir}/L_K is $11M_{\odot}/L_{\odot}$, $15M_{\odot}/L_{\odot}$ and $31M_{\odot}/L_{\odot}$ for pairs, triplets, and groups of galaxies, respectively, which is significantly below the mean global ratio of about $\sim 100M_{\odot}/L_{\odot}$. The median $M_{orb}/L_K = 28M_{\odot}/L_{\odot}$ in our sample is almost identical with the median for groups of galaxies.

As we have already noted, the decrease in the number of 2MIG galaxy–companion pairs with the projected separation R_p happens much slower than should by law, about $R_p^{-1.7}$. The analysis of data from the Table and Fig. 1 reveals the presence of associations of 2MIG galaxies with companions, having similar positions in the sky and close radial velocities. The examples of such associations may be 2MIG 2 and 2MIG 13, 2MIG 239 and 243, 2MIG 1871 and 1873, 2MIG 1987 and 1997. Moreover, in the case of a system of companions around 2MIG 274 and 282, there exists an object LCRS B021927.3–414244, which falls in the interval of $\Delta V < 500$ km/s and $R_p < 500$ kpc with respect to both 2MIG galaxies. The statistics of 2MIG galaxies with $k \geq 5$ number of companions can serve as indirect evidence of the presence of scattered associations. The Table has four such cases, whereas their expected number at the Poisson distribution should be several orders of magnitude smaller.

The presence of diffuse components of the large-scale structure of the universe (filaments, walls), even in the regions of very low matter density, does apparently make the problem of separation of physical and spurious companions of isolated galaxies very difficult. On the other hand, an example of a nearby isolated galaxy NGC 1156 and its dwarf companion AGES J030039+254656 indicates that the estimates of the orbital mass-to-K-luminosity ratio in these indisputably isolated pairs can reach values of around $\sim 200M_{\odot}/L_{\odot}$.

6. CONCLUDING REMARKS

Analyzing the data on radial velocities and projected separations of galaxies in the vicinity of 2MIG

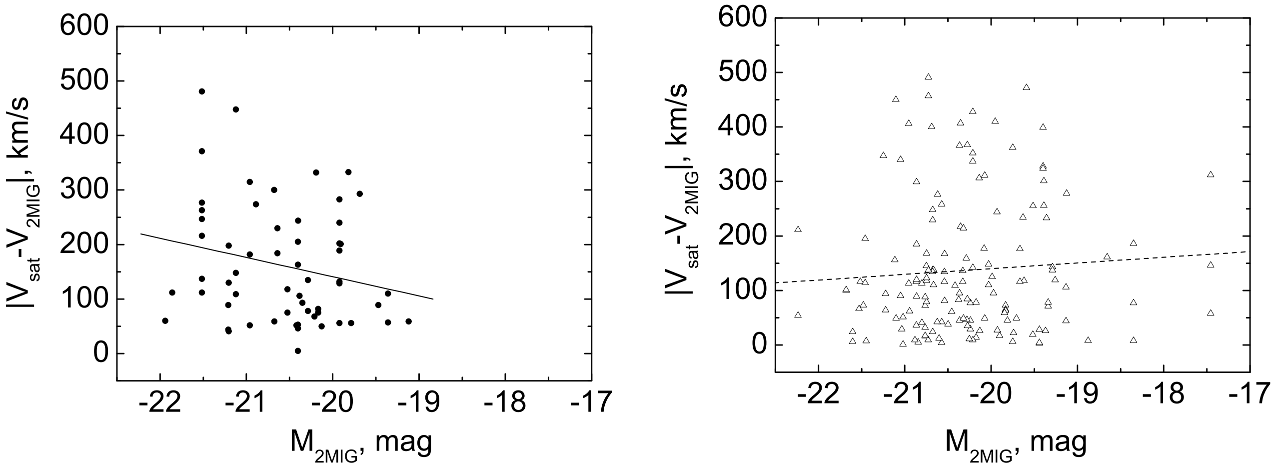

Figure 4: The module of radial velocity difference of a given 2MIG galaxy and its companion, depending on the absolute magnitude of the 2MIG-galaxy. The E and S0 galaxies are located in the left plot, and spiral galaxies — to the right.

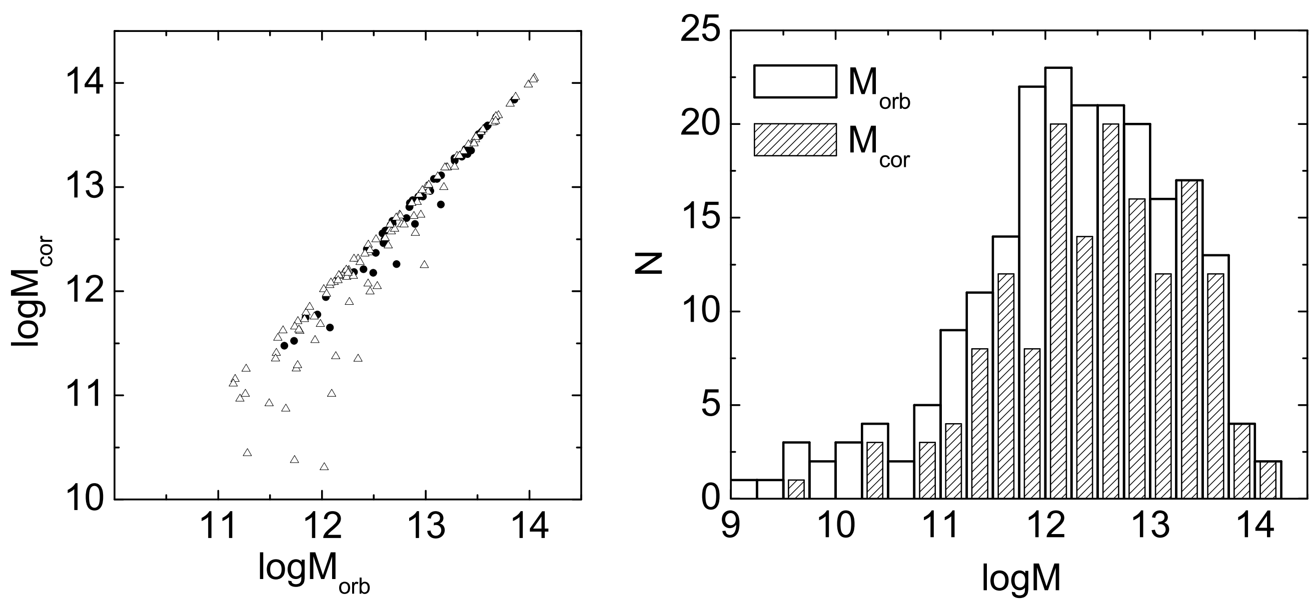

Figure 5: Left plot: the relation between the biased and unbiased estimates of the orbital mass of 2MIG galaxy–companion pairs. Right plot: the distribution of the number of 2MIG galaxy–companion pairs by the biased and unbiased (hatched) orbital mass estimates.

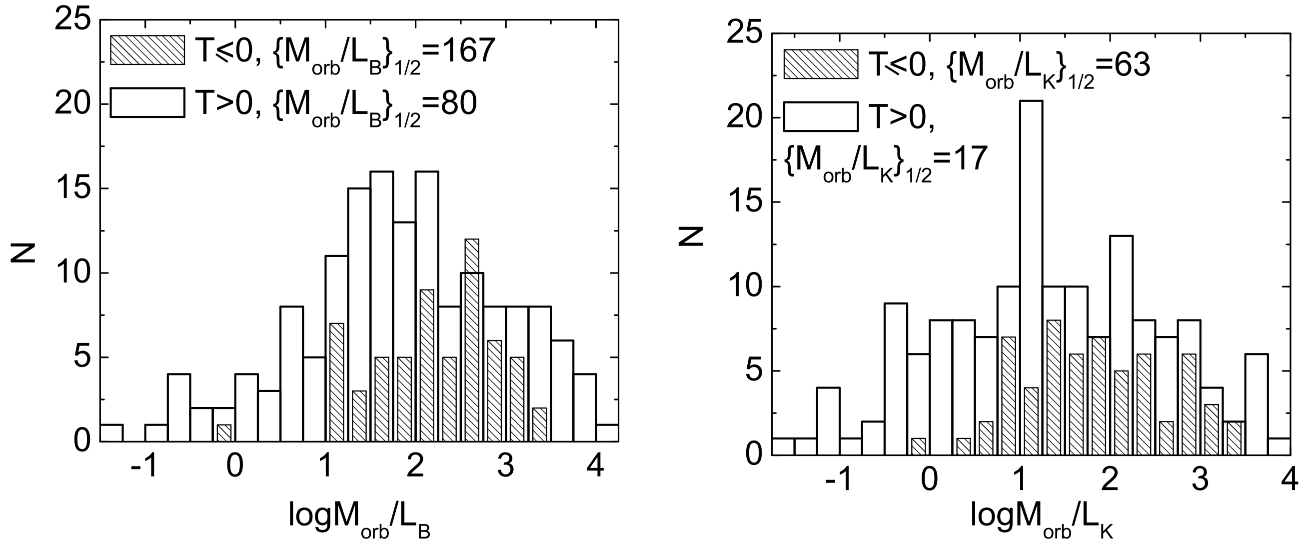

Figure 6: The distribution of 2MIG galaxies with companions by logarithm of the orbital mass-to-luminosity ratio in the B (left) and K (right) bands. 2MIG galaxies of early types are shaded.

catalog objects, we conclude on a good dynamic isolation of the majority of catalog galaxies. According to our estimates, not more than 15% of 2MIG galaxies have small companions in their vicinities with relative velocities of $\Delta V < 500$ km/s and projected separations of $R_p < 500$ kpc. At the characteristic difference of apparent magnitudes of about 3.5^m, these companions have little influence on the evolution of 2MIG galaxies.

The median ratio of the orbital mass to the K-luminosity in isolated galaxies is $17 M_\odot/L_\odot$ for spirals, and $63 M_\odot/L_\odot$ for the E and S0 galaxies. These values can be somewhat inflated due to the presence of false companions from diffuse associations and filaments located in the regions of low galaxy number density in the 2MIG sample. The advent of new data from the surveys of galaxy radial velocities, carried out in the optical (SDSS) and radio (ALFALFA) ranges will certainly allow to explore the features of 2MIG galaxies in more detail.

ACKNOWLEDGMENTS

This study was made owing to the support of the following grants: the grant of the Russian Foundation for Basic Research (RFBR) (project no. 11–02–90449–Ukr–f–a), the grant of the State Foundation for Basic Research of the Ukraine no. F40.2/49, as well as the Cosmomicrophysics program of the National Academy of Sciences of Ukraine. We made use of the NED database (http://nedwww. ipac.caltech.edu), as well as the digital sky surveys DSS (http://archive.eso.org/dss/dss), and SDSS (http://www.sdss.org).

REFERENCES

1. D. Zaritsky, R. Smith, C. Frenk, and S. D. M. White, Astrophys. J. 405, 464 (1993).
2. S. Herbert-Fort, D. Zaritsky, Y. J. Kim, et al., Monthly Notices Roy. Astronom. Soc. 384, 803 (2008).
3. K. N. Abazajian, J. K. Adelman-McCarthy, M. A. Agueros, et al., Astrophys. J. Suppl. 182, 543 (2009).
4. M. Colless et al., Monthly Notices Roy. Astronom. Soc. 328, 1039 (2001).
5. J. P. Huchra, L. M. Macri, K. L. Masters, et al., arXiv: 1108.0669.
6. F. Prada, M. Vitvitska, A. Klypin, et al., Astrophys. J. 598, 260 (2003).
7. J. Chen, A. V. Kravtsov, F. Prada, et al., Astrophys. J. 647, 86 (2006).

8. C. Conroy, F. Prada, J. A. Newman, et al., Astrophys. J. 654, 153 (2007).
9. P. Norberg, C. S. Frenk, and S. Cole, Monthly Notices Roy. Astronom. Soc. 383, 646 (2008).
10. H. S. Hwang and C. Park, Astrophys. J. 720, 522 (2010).
11. L. R. Jones, T. J. Ponman, A. Horton, et al., Monthly Notices Roy. Astronom. Soc. 343, 627 (2003).
12. A. M. von Benda-Beckmann, E. D'Onghia, S. Gottloeber, et al., Monthly Notices Roy. Astronom. Soc. 386, 2345 (2008).
13. R. N. Proctor, C. Mendes de Oliveira, R. Dupke, et al., arXiv: 1108.1349.
14. V. E. Karachentseva, S. N. Mitronova, O. V. Melnyk, and I. D. Karachentsev, Astrophysical Bulletin 65, 1 (2010).
15. V. E. Karachentseva, Soobscheniya SAO 8, 3 (1973).
16. S. Verley, S. Leon, L. Verdes-Montenegro, et al., Astronom. and Astrophys. 472, 121 (2007).
17. M. F. Skrutskie, S. E. Schneider, R. Steining, et al., ASSL 210, 25 (1997).
18. T. N. Jarrett, T. Chester, R. M. Cutri, et al., Astronom. J. 119, 2498 (2000).
19. Yu. N. Kudrya, V. E. Karachentseva, and I. D. Karachentsev, Astrofizika 54, 45 (2011) .
20. R. F. Minchin, E. Momjian, R. Auld, et al., Astronom. J. 140, 1093 (2010).
21. D. J. Schlegel, D. P. Finkbeier, and M. Davis, Astrophys. J. 500, 525 (1998).
22. J. Heisler, S. Tremaine, and J. N. Bahcall, Astrophys. J. 298, 8 (1985).
23. I. D. Karachentsev, Binary Galaxies (Moscow, Nauka, 1987) [in Russian].
24. I. D. Karachentsev and D. I. Makarov, Astrophysical Bulletin 63, 299 (2008).
25. D. I. Makarov and I. D. Karachentsev, Astrophysical Bulletin 64, 24 (2009).
26. D. I. Makarov and I. D. Karachentsev, Monthly Notices Roy. Astronom. Soc. 412, 2498 (2011).

Table 1: A list of 2MIG galaxies and their companions with $\Delta V < 500$ km/s and $R_p < 500$ kpc

2MIG	RA Dec.	T	V_{LG}	σ_V	m_B	R_p	M_B^c	logM_{orb}	$\log(M_{orb}/L_B)$	$\log(M_{orb}/L_K)$
1	2	3	4	5	6	7	8	9	10	11
2	000058.3-333639	5	6942	10	14.72		-20.24			
sat	000136.5-334125		6865	34	17.33	256	-17.60	12.24	1.99	1.59
sat	000132.8-334532		6897	45	16.21	315	-18.73	11.86	1.60	1.21
sat	000003.3-333035		6913	89	18.68	359	-16.26	11.58	1.32	0.93
13	000834.5-335130	3	6823	10	13.3		-21.60			
sat	000829.7-335628		6847	89	18.02	138	-16.90	10.97	0.17	-0.49
sat	000945.6-334438		6817	64	16.64	443	-18.27	10.27	-0.53	-1.19
48	002529.9+455518	3	5353	28	14.68		-19.93			
sat	002701.9+454214		5326	38	17.3	441	-17.30	10.97	0.84	-0.23
62	003040.4-284245	1	7331	100	15.06		-20.03			
sat	003038.4-284301		7221	89	18.71	15	-16.35	11.40	1.23	0.48
sat	003017.0-283052		7183	89	18.67	378	-16.37	12.99	2.82	2.07
64	003135.8+143644	6	11641	16	15.53		-20.76			
sat	003123.9+143059		11713	20	17.8	298	-18.55	12.26	1.80	1.15
sat	003143.0+142911		11657	26	16.8	359	-19.51	11.04	0.57	-0.08
sat	003157.9+142722		11609	20	18.2	500	-18.08	11.75	1.29	0.64
75	003755.6+045441	5	8659	13	15.42		-20.08			
sat	003836.3+045348		8836	32	17.18	351	-18.37	13.12	2.93	2.16
77	003823.7+150222	1	5592	27	14.9		-19.90			
sat	003748.5+145558		5609	24	18.3	237	-16.49	10.85	0.73	0.25
78	003839.9+172410	3	5643	15	14.8		-19.83			
sat	003750.3+172259		5716	14	16.4	268	-18.26	12.21	2.12	1.68
85	004325.7-501058	3	8523	9	13.14		-22.24			
sat	004327.3-500924		8469	5	17.69	54	-17.67	11.27	0.21	-0.15
sat	004300.1-501432		8312	45	16.89	185	-18.43	12.99	1.93	1.57
90	004712.8+290811	2	5948	33	15.95		-18.88			
sat	004632.9+290118		5940	130	18.6	263	-16.21	10.30	0.59	-0.30
108	005502.4-134041	-2	6375	36	15.03		-19.79			
sat	005510.1-133031		6431	45	16.2	359	-18.63	12.12	2.05	1.37
110	005652.4-315747	0	5611	38	14.59		-19.91			
sat	005720.4-315113		5812	64	18.83	198	-15.75	12.97	2.85	2.21
158	012853.2+134738	5	6547	17	14.8		-20.17			
sat	012906.4+134539		6625	20	17.5	98	-17.49	11.85	1.62	1.18
sat	012855.8+140436		6533	21	16.3	443	-18.61	11.07	0.84	0.40
159	012902.9+321956	0	5622	34	14.49		-20.19			
sat	012920.8+320352		5290	14	17	370	-17.49	13.68	3.44	2.89
160	013029.1-224003	5	1645	3	11.44		-20.37			
sat	013011.9-224545		1562	45	15.91	46	-15.80	11.56	1.25	1.14
165	013142.1-005600	2	5542	20	14		-20.57			
sat	013128.0-005603		5500	19	17.6	78	-16.94	11.21	0.82	-0.08
sat	013154.6-004853		5500	16	17.1	172	-17.44	11.55	1.17	0.27
sat	013050.5-004459		5284	33	18.3	375	-16.12	13.47	3.08	2.18
sat	013028.1-004348		5538	18	16.77	490	-17.75	10.16	-0.23	-1.13
186	014035.7-333717	0	8791	34	15.1		-20.38			
sat	014044.0-333123		8685	123	18.73	215	-16.73	12.46	2.15	1.32
194	014314.2+085322	3	5677	11	13.76		-20.95			
sat	014253.4+084920		5564	31	17	148	-17.63	12.35	1.81	1.21
sat	014354.3+083729		5271	34	18.9	423	-15.60	12.65	2.11	1.52
212	015541.1-295520	0	4327	14	13.41		-20.52			
sat	015557.7-300014		4402	30	17.91	105	-16.07	11.84	1.47	0.73
sat	015524.3-301926		4445	30	15.96	420	-18.04	12.85	2.48	1.73
222	015808.5+020352	6	6393	12	14.91		-19.93			
sat	015804.7+020237		6637	6	19	40	-15.92	12.45	2.31	1.76
226	020008.9+123922	2	3623	22	14.03		-19.74			
sat	020001.9+123218		3645	10	18.2	105	-15.61	10.78	0.72	0.09

1	2	3	4	5	6	7	8	9	10	11
239	020540.3-004141	5	12904	13	15.7		-20.68			
sat	020519.5-004325		12880	18	17.8	282	-18.56	11.28	0.85	0.10
sat	020600.1-004531		13133	24	18.1	322	-18.32	13.30	2.87	2.12
sat	020504.8-004242		13042	26	17.1	459	-19.29	13.01	2.58	1.83
sat	020525.0-003320		12656	27	16.8	473	-19.51	13.54	3.10	2.36
243	020616.0-001729	0	12807	30	14.4		-21.94			
sat	020619.1-002126		12867	19	18.6	206	-17.75	11.96	1.02	0.42
253	021006.1-325623	1	3293	10	13.12		-20.21			
sat	021028.0-325514		3630	123	19.02	62	-14.52	12.92	2.68	2.13
sat	021007.5-324806		2941	64	17.87	109	-15.22	13.20	2.96	2.41
sat	021044.7-324222		3721	123	19.43	212	-14.17	13.66	3.42	2.87
sat	020807.1-331043		3151	89	19.13	377	-14.11	12.95	2.71	2.16
sat	020720.5-330157		3302	89	17.38	461	-15.95	10.54	0.30	-0.25
274	021958.6-412411	3	4952	13	13.55		-20.67			
sat	022126.9-412905		4842	47	16.4	341	-17.76	12.67	2.24	1.73
sat	021906.9-414458		5090	11	15.3	452	-18.98	13.01	2.59	2.07
282	022247.3-412216	-2	4972	40	13.02		-21.21			
sat	022126.9-412905		4842	47	16.4	328	-17.76	12.82	2.17	1.82
sat	022435.9-412306		5170	26	16.01	404	-18.30	13.28	2.64	2.29
sat	022438.1-412832		4931	30	16.83	430	-17.38	11.89	1.24	0.89
285	022528.3-253817	4	4808	4	14.09		-20.07			
sat	022505.8-253246		4759	123	18.97	144	-15.16	11.61	1.42	1.34
sat	022554.4-252613		5119	89	19.17	257	-15.11	13.46	3.28	3.20
295	023036.2-313546	6	4566	37	14.93		-19.13			
sat	023011.0-313628		4610	89	18.3	98	-15.78	11.35	1.54	1.20
sat	023009.7-313619		4460	89	18.53	103	-15.48	12.14	2.32	1.98
319	024222.6-301920	-2	6435	19	14.16		-20.68			
sat	024240.0-302103		6494	89	18.54	106	-16.31	11.64	1.21	0.75
331	024816.1+342511	2	5462	12	13.99		-20.75			
sat	024822.4+340612		5317	10	17	414	-17.70	13.01	2.55	2.14
340	025158.8-332025	3	6310	10	14.45		-20.35			
sat	025202.2-332219		6527	89	18.74	51	-16.14	12.45	2.15	1.32
sat	025155.6-331710		6717	89	19.38	83	-15.56	13.21	2.91	2.07
394	031500.8-304229	3	4541	8	14.4		-19.63			
sat	031505.8-304247		4307	64	18.27	20	-15.65	12.12	2.11	1.38
400	031713.2-323433	5	4431	7	13.26		-20.73			
sat	031653.7-324343		3940	89	18.88	177	-14.84	13.70	3.25	2.62
407	032040.8-072340	-2	5462	24	14.4		-20.21			
sat	032106.1-071656		5394	18	17.4	200	-17.20	12.04	1.79	1.33
516	041400.6+365052	3	6148	9	15.3		-21.45			
sat	041246.4+365350		6155	9	17	371	-19.48	10.20	-0.54	-0.98
563	042849.1-445145	-2	4372	46	14.14		-19.82			
sat	042850.9-444802		4705	53	17.79	65	-16.32	12.93	2.84	2.26
710	052644.5-191235	5	8108	13	14.76		-20.73			
sat	052613.0-192440		8099	46	16.7	77	-18.80	9.87	-0.58	-1.40
777	055825.4+682740	3	4287	15	13.68		-20.60			
sat	055646.0+684436		4299	33	15.2	328	-19.07	10.67	0.27	-0.20
1007	073737.1+415649	5	5917	6	14.8		-19.97			
sat	073729.8+415550		5822	3	18.4	40	-16.33	11.62	1.48	1.09
1008	073836.5+373801	6	3892	7	14.5		-19.40			
sat	073913.7+374037		3564	3	18.2	121	-15.52	13.19	3.27	3.13
sat	073951.9+374916		3568	7	18	290	-15.71	13.56	3.64	3.50
sat	073934.5+380141		3493	3	17.5	253	-16.17	13.68	3.76	3.62
1082	080448.1+204138	5	9260	9	14.2		-21.48			
sat	080420.8+205213		9333	54	16.7	456	-19.00	12.45	1.69	1.50
1093	081015.2+335724	5	5219	4	13.7		-20.80			
sat	081025.2+340016		5178	4	16.6	74	-17.89	11.16	0.68	0.06
sat	081021.1+340159		5332	27	18.5	99	-16.05	12.17	1.69	1.07

1	2	3	4	5	6	7	8	9	10	11
1098	081406.8+235159	0	5961	20	14.5		-20.29			
sat	081403.8+235329		5883	288	17.9	39	-16.86	11.45	1.17	0.87
sat	081407.3+234243		6096	30	17.6	220	-17.22	12.68	2.41	2.10
1208	085832.8+281602	2	7927	7	14.2		-21.11			
sat	085831.1+281532		8083	56	17.2	20	-18.16	11.77	1.16	0.26
1241	091458.3+512140	5	8298	22	14.6		-20.75			
sat	091448.1+512542		8180	16	18	23	-17.32	11.58	1.12	0.24
sat	091409.0+512505		8466	18	18.4	44	-16.99	12.17	1.71	0.83
sat	091618.3+512357		8421	16	18.3	67	-17.09	12.08	1.62	0.74
sat	091329.8+511855		8377	24	18	74	-17.36	11.74	1.28	0.40
1273	092908.2-023257	4	6745	39	14.14		-20.85			
sat	092945.3-022108		6750	47	15.6	404	-19.39	10.08	-0.42	-1.10
1280	093011.7+555109	3	7614	12	14.7		-20.54			
sat	092948.1+554642		7781	28	17.6	168	-17.68	12.75	2.37	2.13
sat	092956.4+553917		7695	29	16	366	-19.23	12.46	2.09	1.84
1298	093652.5+374142	2	4343	10	14.6		-19.34			
sat	093617.0+373751		4414	40	17.8	138	-16.17	11.93	2.03	1.61
sat	093801.6+375521		4421	32	17.5	334	-16.48	12.37	2.47	2.06
1304	093823.4+433033	0	4435	48	14.5		-19.47			
sat	093837.9+432846		4524	28	17.6	56	-16.41	11.73	1.78	1.52
1326	094541.5+045631	1	3550	15	13.85		-19.75			
sat	094555.9+050258		3544	290	17.2	105	-16.38	9.65	-0.41	-0.44
sat	094738.6+044918		3188	65	16.3	425	-17.04	13.82	3.76	3.73
1336	095056.2+621109	2	7476	23	14.9		-20.27			
sat	095242.1+621651		7441	17	18.2	405	-16.96	11.77	1.50	1.19
1352	095449.5+091616	2	1283	11	13.04		-18.35			
sat	095407.3+092136		1291	90	17.1	60	-14.27	9.66	0.16	0.48
sat	095430.5+095212		1360	366	17.7	185	-13.80	12.09	2.59	2.91
sat	095529.7+082326		1097	29	15.4	275	-15.65	13.03	3.53	3.85
1363	095929.5-224935	0	2105	17	12.85		-19.69			
sat	095919.6-224424		1812	17	16.9	47	-15.31	12.68	2.64	3.04
1382	100453.9+050346	-2	3804	46	14.3		-19.36			
sat	100551.3+050022		3747	379	17.9	223	-15.75	11.93	2.03	1.70
sat	100447.8+052210		3914	31	15.7	280	-18.02	12.59	2.69	2.36
1394	100820.6+315146	3	5122	8	14		-20.33			
sat	100751.7+315247		5238	64	17.2	127	-17.15	12.31	2.01	1.21
sat	100746.6+315338		5258	30	16.6	152	-17.75	12.52	2.23	1.42
1439	102915.5+060741	6	3380	11	14.8		-18.66			
sat	102824.7+061419		3541	80	16.4	192	-17.14	12.77	3.15	2.54
1465	104028.4+091057	0	5592	12	13.6		-20.96			
sat	104026.1+091537		5774	43	17.8	104	-16.83	12.61	2.07	2.21
sat	104008.8+091629		5277	32	17.9	163	-16.53	13.28	2.74	2.88
sat	104040.1+092449		5644	72	17.5	316	-17.07	12.00	1.46	1.60
1488	104857.5-044538	5	7707	28	14.78		-20.54			
sat	104852.5-044849		7841	124	19.37	105	-15.98	12.35	1.97	1.41
sat	104915.0-044132		7823	90	19.14	184	-16.19	12.46	2.09	1.53
1495	105115.1+022616	1	15216	57	15.1		-21.68			
sat	105115.5+022728		15116	53	18.5	73	-18.26	11.93	1.10	0.56
sat	105056.0+022600		15115	59	18.3	290	-18.47	12.53	1.70	1.16
1502	105444.3-170231	5	3991	48	14.5		-19.39			
sat	105421.8-172626		4247	37	15.13	390	-18.87	13.48	3.57	2.92
sat	105428.7-163649		4292	48	16.4	413	-17.68	13.64	3.73	3.08
1507	105550.0+312332	3	10474	43	15.5		-20.42			
sat	105517.5+312639		10365	50	18.2	318	-17.68	12.64	2.31	0.97
1512	105809.8-004629	5	6204	23	15.5		-19.36			
sat	105831.2-010025		6437	26	17.7	369	-17.24	11.56	1.66	0.74

1	2	3	4	5	6	7	8	9	10	11
1524	110037.2+112455	2	8049	52	15		-20.29			
sat	110041.3+112320		8208	25	17.8	60	-17.53	12.25	1.98	1.00
1538	110434.5+160342	0	6233	27	14.1		-20.64			
sat	110422.9+160624		6417	38	18.4	96	-16.40	12.58	2.17	2.07
sat	110458.3+161040		6003	58	17.9	224	-16.76	13.15	2.73	2.64
1539	110523.9-023142	1	8724	64	15.72		-19.95			
sat	110513.5-022851		8314	90	18.65	131	-16.92	12.79	2.65	2.06
1543	110656.6+071026	6	1252	12	13.86		-17.45			
sat	110559.6+072225		1564	116	17.4	93	-14.40	13.02	3.88	3.64
sat	111128.3+065427		1398	21	14.8	346	-16.82	12.94	3.80	3.55
sat	110301.7+080253		1194	10	18.1	391	-13.13	12.23	3.09	2.85
1554	111315.9+033926	0	6627	53	14.8		-20.17			
sat	111320.2+033713		6552	58	18.3	65	-16.64	11.62	1.40	0.94
sat	111221.7+034540		6545	26	15.9	393	-19.06	12.49	2.27	1.81
1613	113903.3-001222	5	5242	14	14.8		-19.59			
sat	113929.7+000700		5714	19	16.8	427	-17.77	14.05	4.05	3.53
1614	113911.0+392002	3	7195	30	15.2		-19.83			
sat	113850.9+391716		7130	0	19.5	137	-15.51	11.83	1.74	1.21
sat	113838.9+391556		7132	32	17.4	213	-17.61	11.99	1.89	1.36
1655	115601.0-024315	0	5773	32	14.2		-20.40			
sat	115548.3-024434		5826	90	18.8	79	-15.82	11.40	1.08	1.05
sat	115613.2-024029		5819	39	18.3	95	-16.31	11.37	1.05	1.02
sat	115658.4-023804		5768	82	18.1	351	-16.47	10.31	-0.01	-0.05
sat	115707.1-023159		5936	111	18.1	460	-16.54	13.15	2.83	2.80
sat	115702.0-022853		5568	29	17	482	-17.50	13.39	3.07	3.03
1657	115651.6+084252	3	10373	9	16.5		-19.37			
sat	115654.2+084643		10347	25	17.9	161	-17.95	11.14	1.23	-0.09
1666	120236.5+410315	4	6154	10	13.82		-20.87			
sat	120219.9+410454		6190	3	16.9	87	-17.80	11.15	0.64	-0.47
sat	120227.4+404913		6270	29	18.2	347	-16.53	12.76	2.25	1.14
1672	120528.8+464647	4	9399	39	15.5		-20.13			
sat	120543.9+465548		9425	24	17.4	351	-18.23	11.45	1.23	-0.30
1680	120932.9+170051	-2	6619	8	14.54		-20.40			
sat	120836.4+171243		6863	58	15.4	474	-19.67	13.52	3.20	2.94
1704	121859.0-200451	4	5398	34	14.31		-20.27			
sat	121857.5 -200029		5765	210	18.2	94	-16.52	13.18	2.91	2.87
1718	122435.0+015332	4	7031	53	15.9		-19.13			
sat	122502.8+014738		6753	33	18.1	255	-16.82	13.37	3.56	2.85
1723	122545.5+514006	0	9190	32	14.9		-20.68			
sat	122541.2+514901		9490	26	18	328	-17.65	13.54	3.11	2.47
1743	123344.9+521517	0	6695	36	14.54		-20.35			
sat	123418.0+520947		6788	29	18.4	200	-16.52	12.31	2.01	1.46
1748	123600.1+541316	3	5450	11	14		-20.46			
sat	123538.1+541350		5511	51	17.7	71	-16.77	11.49	1.15	0.86
1750	123713.5+492654	5	9061	51	14.5		-21.03			
sat	123755.2+493058		9090	29	17.9	285	-17.64	11.42	0.85	0.70
1767	124426.2+370716	2	7007	6	13.9		-21.10			
sat	124313.5+370507		6557	50	17.7	409	-17.13	13.99	3.39	3.36
1768	124428.1-030019	4	7003	11	14.9		-20.14			
sat	124504.7-030406		7309	28	16.8	276	-18.32	13.48	3.27	2.37
1773	124611.5+484003	3	9325	34	15.3		-20.28			
sat	124500.3+483744		9371	42	16	445	-19.59	12.05	1.77	1.01
1814	130743.7-123333	-2	6296	38	14.75		-20.13			
sat	130822.2-124053		6246	52	16.62	299	-18.23	11.95	1.73	0.66
1820	130933.1+014023	4	5522	11	13.3		-21.25			
sat	130934.4+013725		5869	17	16.6	66	-18.08	12.97	2.31	2.52

1	2	3	4	5	6	7	8	9	10	11
1828	131222.9-042011	1	3003	9	13.24		-19.99			
sat	131049.7-045101		2878	89	16.77	462	-16.36	12.90	2.75	3.08
1838	131446.0+534913	1	4832	34	14.5		-19.71			
sat	131252.5+535722		4881	36	17.6	358	-16.63	12.02	1.98	1.79
1846	131908.2+283025	3	6651	1	14.2		-20.68			
sat	131958.3+281449		6785	19	15.5	506	-19.42	13.03	2.60	2.34
1855	132654.2+524513	-2	9036	39	14.4		-21.12			
sat	132630.3+524230		9484	37	17.9	163	-17.73	13.59	2.98	2.41
sat	132611.8+524501		9145	45	17.8	231	-17.75	12.52	1.91	1.34
sat	132807.5+525008		9184	47	16.6	436	-18.95	13.05	2.44	1.87
1871	133439.2+040748	3	6776	33	14.7		-20.25			
sat	133451.0+041412		6765	6	17.6	190	-17.35	10.43	0.17	-0.29
1873	133548.2+025956	2	6424	34	14.1		-20.73			
sat	133542.8+030007		6561	17	17	34	-17.87	11.88	1.43	1.47
sat	133540.3+031735		6881	17	16	444	-18.98	14.04	3.59	3.62
1915	135317.8+332927	2	2383	20	13.4		-19.26			
sat	134913.0+331900		2264	62	18.2	495	-14.33	12.89	3.02	2.88
1919	135656.0+290952	2	2418	4	13.4		-19.29			
sat	135709.9+291310		2275	4	17.4	43	-15.13	12.02	2.14	1.88
sat	135729.7+290332		2281	2	19.33	93	-13.20	12.31	2.43	2.17
1922	135806.6-040509	5	7422	8	14.84		-20.37			
sat	135818.4-040141		7056	89	19.1	135	-15.99	13.33	3.02	2.64
sat	135837.5-040135		7377	89	19.2	251	-15.99	11.78	1.47	1.09
sat	135830.5-035253		7327	123	17.52	403	-17.65	12.64	2.33	1.95
1987	142908.3+414951	1	5518	30	15		-19.44			
sat	142945.7+415158		5490	9	18.3	160	-16.12	11.20	1.26	0.78
sat	142938.7+415747		5515	34	17.5	214	-16.94	9.36	-0.58	-1.06
sat	142833.5+420224		5514	30	17.5	311	-16.93	9.77	-0.17	-0.65
1997	143316.4+413901	3	5435	60	14.8		-19.62			
sat	143322.0+414023		5553	30	17.6	37	-16.86	11.79	1.78	0.85
2012	143911.1+052149	0	1470	2	11.76		-19.92			
sat	143944.4+052112		1753	70	17	49	-15.08	12.66	2.54	2.65
sat	144027.5+053155		1526	30	18	126	-13.76	11.64	1.51	1.63
sat	143822.5+043648		1659	4	17.9	273	-14.07	13.08	2.95	3.07
sat	143522.8+051636		1599	5	17.5	338	-14.34	12.85	2.72	2.84
sat	144258.0+045322		1602	6	13.6	371	-18.27	12.88	2.75	2.86
sat	144302.8+044556		1672	7	14.9	398	-17.05	13.28	3.15	3.27
sat	144329.2+043153		1710	17	16.7	477	-15.29	13.51	3.38	3.50
2018	144331.3+492335	3	9184	33	15.3		-20.32			
sat	144334.0+492451		9398	67	18.5	49	-17.16	12.42	2.13	1.65
sat	144419.4+492443		9233	57	17.6	290	-18.01	11.90	1.61	1.13
2023	144441.1-042019	5	13091	64	16.36		-20.28			
sat	144419.6-042038		13007	89	19.51	279	-17.08	12.36	2.09	0.79
2029	144826.7+345953	3	8916	11	14.5		-21.02			
sat	144854.9+345214		8865	69	18.3	341	-17.19	12.00	1.43	1.06
sat	144825.9+350932		8915	23	18.2	343	-17.29	9.21	-1.36	-1.73
2034	145138.9+403557	3	5017	10	13.5		-20.76			
sat	145055.5+403126		5000	71	18.3	188	-15.95	10.75	0.29	-0.28
sat	145001.6+402142		4929	38	18.3	467	-15.90	12.61	2.14	1.58
2065	150654.8+001111	2	10506	28	15		-21.05			
sat	150654.5+001059		10166	21	18.6	9	-17.38	12.09	1.51	0.09
sat	150702.0+001323		10596	21	18.5	119	-17.57	12.05	1.47	0.05
2130	153626.3-665135	4	3294	14	12.4		-21.53			
sat	153621.4-665257		3228	113	16.4	19	-17.47	12.25	1.48	2.35
2133	153722.9+203259	0	4604	48	15.1		-19.12			
sat	153741.3+204713		4545	5	18.2	273	-16.00	12.08	2.27	1.61

1	2	3	4	5	6	7	8	9	10	11
2174	155601.6+302503	3	14125	47	15.1		-21.52			
sat	155622.7+302715		14241	25	18.2	317	-18.42	12.70	1.94	1.22
2333	170128.2+634128	5	4974	19	14.6		-19.67			
sat	170026.3+634341		5150	20	16.6	143	-17.75	12.72	2.69	2.49
sat	170457.2+634848		5090	17	16.5	481	-17.85	12.87	2.84	2.64
2394	173044.8+562107	2	9361	30	15		-20.69			
sat	173029.8+561050		8961	22	17.8	391	-17.79	13.87	3.43	2.98
2482	181649.3-571353	1	5000	20	13.8		-20.88			
sat	181637.2-571534		5009	46	17.4	47	-17.28	9.65	-0.86	-0.68
2716	195647.6-602805	-2	3658	30	12.5		-21.21			
sat	195557.0-604356		3702	45	15.23	248	-18.52	11.79	1.15	0.88
sat	195622.5-604533		3747	45	15.75	258	-18.03	12.40	1.76	1.49
2777	202313.8-274252	-2	5808	27	12.95		-21.86			
sat	202306.5-273116		5920	45	16.8	271	-18.04	12.60	1.70	1.05
2816	204052.1+003910	4	8256	16	15.8		-19.81			
sat	204119.8+003937		8211	41	17.4	228	-18.20	11.74	1.65	0.84
2834	204952.2-070119	5	6225	13	15.4		-19.51			
sat	204929.4-064849		6480	19	18.1	340	-16.89	13.41	3.45	2.42
2857	210203.5-061749	3	7941	16	14.4		-21.10			
sat	210159.0-062030		7892	22	18.6	93	-16.87	11.26	0.66	0.04
2875	210826.9-054910	2	8551	24	14.8		-20.94			
sat	210814.0-055108		8613	24	17.4	128	-18.36	11.78	1.24	0.70
2986	215656.7-252102	3	8847	64	14.73		-20.86			
sat	215659.1-252132		8727	89	18.03	26	-17.53	11.65	1.15	0.70
sat	215726.7-252949		8936	64	17.35	391	-18.24	12.57	2.07	1.63
sat	215608.7-252736		9146	64	18.07	447	-17.56	13.68	3.17	2.73
sat	215635.4-250841		8662	45	16.77	467	-18.76	13.28	2.78	2.33
2998	220344.5-274754	0	7115	24	14.61		-20.42			
sat	220338.5-275831		7063	64	18.1	303	-16.93	11.97	1.64	0.88
3010	221048.6-435749	4	12903	45	15.68		-20.62			
sat	221140.4-435533		12945	89	19.41	498	-16.89	11.99	1.59	0.91
3020	221606.2-302208	4	7734	11	14.58		-20.62			
sat	221555.3-301143		8010	89	19.35	329	-15.91	13.47	3.06	2.62
3023	221820.5+133725	3	7733	30	15.6		-19.84			
sat	221842.0+132930		7792	49	18.8	292	-16.66	12.09	2.00	0.29
3034	222342.4-263646	4	7612	31	13.96		-21.22			
sat	222408.3-263727		7518	64	19.1	177	-16.04	12.26	1.62	1.26
sat	222421.7-264029		7548	123	18.49	289	-16.66	12.15	1.50	1.15
sat	222253.2-263853		7548	89	18.84	342	-16.31	12.22	1.57	1.22
3051	222955.4-081646	4	10758	31	14.64		-21.46			
sat	222947.1-081601		10872	24	18.3	94	-17.83	12.16	1.41	0.85
sat	222959.2-081857		10563	24	18	103	-18.04	12.66	1.92	1.35
3077	224142.1-324552	4	8483	45	15.87		-19.52			
sat	224100.5-324118		8502	89	18.07	334	-17.31	11.11	1.14	0.26
3083	224424.4-000944	0	5070	13	13.6		-20.89			
sat	224446.8-000513		5344	70	18.4	146	-16.21	13.11	2.60	1.95
3120	230632.4-252539	3	15841	45	16.3		-20.50			
sat	230628.9-252501		15879	64	18.5	64	-18.30	11.04	0.68	-0.25
3194	234547.5-293104	0	10424	20	14.34		-21.52			
sat	234550.2-293041		10147	64	17.83	30	-17.97	12.43	1.67	0.88
sat	234556.3-293224		10177	64	18.56	97	-17.24	12.84	2.08	1.29
sat	234533.8-293254		9943	45	17.44	145	-18.31	13.60	2.83	2.05
sat	234544.7-292431		10687	89	18.83	273	-17.08	13.35	2.58	1.80
sat	234606.3-293818		10536	89	18.7	347	-17.17	12.72	1.95	1.17
sat	234615.4-292512		10287	89	19.14	351	-16.69	12.90	2.13	1.34
sat	234620.0-292307		10053	64	18.06	441	-17.72	13.86	3.09	2.30
sat	234506.4-292444		10208	89	18.32	456	-17.49	13.40	2.64	1.85
sat	234615.9-292057		10208	89	16.98	492	-18.83	13.44	2.67	1.88